DETAILED DESCRIPTION OF INVENTION

The method and apparatus comprises a number of steps carried out by a computer. Several of these steps are novel and their application results in commercially useful, unified models. A key benefit is that the use of a single, unified and coherent approach leads to reductions in the amount of data and range of different models required in order to analyse different securities or assets. These reductions can provide significant savings in terms of the computer resources required by users. Particular embodiments of the invention are also provided.

Preferred embodiments and applications of the invention will now be described with reference to Figures 5 to 9. Other embodiments may be realised and structural or logical changes may be made to the disclosed embodiments without departing from the spirit or scope of the invention.

In a preferred embodiment, the invention is implemented in a financial instrument engine **100**, as shown in Figure 5, used to analyse financial and economic signals provided by the financial markets and, based upon user input data and commands, issue position statements or reports for use by the user (or other components or systems), as well as issuing control signals for use by automated systems to effect positions (e.g., increase, decrease, change, etc.) held by the user in the financial markets. The financial engine **100** may be a stand-alone computer hardware system, incorporated in (or distributed among) one or more locally or remotely located computer systems.

In a preferred embodiment, financial engine **100** is composed of a plurality of modules: data source **10**, risk analysis unit **12**, risk pricing unit **13**, financial instrument controller **15**, financial modelling unit **16**, and user interface device **17**. In the illustrated embodiment, the modules are connected by a single transmission bus **14**. (It should be understood that the illustration of bus **14** is merely representative of the various connectivity technologies available to those of ordinary skill in the art including single/multiple, wired, wireless, fibre optic and other transmission mediums.)

r_V is the rate of return on the firm's assets, per annum

y is the promised yield on the firm's debt, per annum

$$d_1 = \left(\left[\ln\left(V_0/X\right) + r_V T\right] \Big/ \sigma_V \sqrt{T}\right) + (1/2)\left(\sigma_V \sqrt{T}\right)$$

$$d_2 = d_1 - \sigma_V \sqrt{T}$$

$N(.)$ is the cumulative probability of the standard normal distribution with d_1 or d_2 as the upper limit

r is the risk free rate of return, per annum

σ_V is the standard deviation of rates of return on the firm's assets, per annum

σ_B is the standard deviation of rates of return on the firm's debt, per annum

σ_S is the standard deviation of rates of return on the firm's equity, per annum.

44. A computer implemented method for applying an option-theoretic model of a firm comprising the steps of generating one or more risk parameters from the model, estimated over a discrete time period, and solving the model so that the said parameters equal values specified by a user.

45. The computer implemented method of claim 44, wherein one of the said risk parameters is a statistical moment of the returns of one or more of the securities issued by, or referenced to, the firm.

46. The computer implemented method of claim 44, wherein one of the said risk parameters is the correlation between the returns of a pair of securities issued by, or referenced to, the firm.

47. The computer implemented method of claim 44, wherein one of the said risk parameters is the covariance between the returns of a pair of securities issued by, or referenced to, the firm.

48. The computer implemented method of claim 44, wherein one of the said risk parameters is the correlation between the returns of a security issued by, or referenced to, the firm and the returns of the total firm.

49. The computer implemented method of claim 44, wherein one of the said risk parameters is the covariance between the returns of a security issued by, or referenced to, the firm and the returns of the total firm.

50. The computer implemented method of any one of claims 19 to 22, claim 30 or claims 41 to 49, wherein the formula for calculating additional parameters, being instantaneous volatility, for calibration with the model comprise:

$$\sigma_B = \sigma_V \frac{V_0}{B_0} e^{(r_V - r_B)T} [1 - N(d_1)]$$

$$\sigma_S = \sigma_V \frac{V_0}{S_0} e^{(r_V - r_S)T} N(d_1)$$

51. The computer implemented method of any one of claims 19 to 22, claims 30 to 34, or claims 41 to 49, wherein the formula for calculating additional parameters, being discrete time volatility, correlation and covariance, for calibration with the model comprise:

$$\sigma_B = \sqrt{\ln\left(\frac{V_T^2 [1 - N(d_3)] e^{\sigma_V^2 T} + X^2 N(d_2)}{B_T^2}\right) \Big/ T}$$

$d_2 = d_1 - \sigma_V \sqrt{T}$

$N(.)$ is the cumulative probability of the standard normal distribution with d_1 or d_2 as the upper limit

r is the risk free rate of return, per annum

σ_V is the standard deviation of rates of return on the firm's assets, per annum

σ_B is the standard deviation of rates of return on the firm's debt, per annum

σ_S is the standard deviation of rates of return on the firm's equity, per annum.

95. A system for applying an option-theoretic model of a firm, the system comprising:

a computer-readable memory;

a processing unit operative to generate one or more risk parameters from the said option-theoretic model, estimated over a discrete time period, and solve the model so that the said parameters equal values specified by a user.

96. The computer system of claim 95, wherein the processing unit is further operative to use as one of the said risk parameters a statistical moment of the returns of one or more of the securities issued by, or referenced to, the firm.

97. The computer system of claim 95, wherein the processing unit is further operative to use as one of the said risk parameters the correlation between the returns of a pair of securities issued by, or referenced to, the firm.

98. The computer system of claim 95, wherein the processing unit is further operative to use as one of the said risk parameters the covariance between the returns of a pair of securities issued by, or referenced to, the firm.

99. The computer system of claim 95, wherein the processing unit is further operative to use as one of the said risk parameters the correlation between the returns of a security issued by, or referenced to, the firm and the returns of the total firm.

100. The computer system of claim 95, wherein the processing unit is further operative to use as one of the said risk parameters the covariance between the returns of a security issued by, or referenced to, the firm and the returns of the total firm.

101. The computer system of any one of claims 70 to 73, claim 81 or claims 92 to 100, wherein the processing unit is further operative to use formula for calculating additional parameters, being instantaneous volatility, for calibration with the model, said formula comprising:

$$\sigma_B = \sigma_V \frac{V_0}{B_0} e^{(r_V - r_B)T} [1 - N(d_1)]$$

$$\sigma_S = \sigma_V \frac{V_0}{S_0} e^{(r_V - r_S)T} N(d_1)$$

102. The computer system of any one of claims 70 to 73, claims 81 to 85, or claims 92 to 100, wherein the processing unit is further operative to use formula for calculating additional parameters, being discrete time volatility, correlation and covariance, for calibration with the model, said formula comprising:

$$\sigma_B = \sqrt{\ln\left(\frac{V_T^2 [1 - N(d_3)] e^{\sigma_V^2 T} + X^2 N(d_2)}{B_T^2}\right) \Big/ T}$$

r_V is the rate of return on the firm's assets, per annum

y is the promised yield on the firm's debt, per annum

$$d_1 = \left(\left[\ln\left(V_0/X\right) + r_V T\right]/\sigma_V \sqrt{T}\right) + (1/2)\left(\sigma_V \sqrt{T}\right)$$

$$d_2 = d_1 - \sigma_V \sqrt{T}$$

$N(.)$ is the cumulative probability of the standard normal distribution with d_1 or d_2 as the upper limit

r is the risk free rate of return, per annum

σ_V is the standard deviation of rates of return on the firm's assets, per annum

σ_B is the standard deviation of rates of return on the firm's debt, per annum

σ_S is the standard deviation of rates of return on the firm's equity, per annum.

146. A computer readable medium having computer-executable instructions for performing a method to apply an option-theoretic model of a firm, said method comprising the steps of generating one or more risk parameters from the model, estimated over a discrete time period, and solving the model so that the said parameters equal values specified by a user.

147. The computer-readable medium of claim 146, wherein one of the said risk parameters analysed by the computer-executable instructions is a statistical moment of the returns of one or more of the securities issued by, or referenced to, the firm.

148. The computer-readable medium of claim 146, wherein one of the said risk parameters analysed by the computer-executable instructions is the correlation between the returns of a pair of securities issued by, or referenced to, the firm.

149. The computer-readable medium of claim 146, wherein one of the said risk parameters analysed by the computer-executable instructions is the covariance between the returns of a pair of securities issued by, or referenced to, the firm.

150. The computer-readable medium of claim 146, wherein one of the said risk parameters analysed by the computer-executable instructions is the correlation between

the returns of a security issued by, or referenced to, the firm and the returns of the total firm.

151. The computer-readable medium of claim 146, wherein one of the said risk parameters analysed by the computer-executable instructions is the covariance between the returns of a security issued by, or referenced to, the firm and the returns of the total firm.

152. The computer-readable medium of any one of claims 121 to 124, claim 132 or claims 143 to 151, wherein the computer-executable instructions use formula for calculating additional parameters, being instantaneous volatility, for calibration with the model, said formula comprising:

$$\sigma_B = \sigma_V \frac{V_0}{B_0} e^{(r_V - r_B)T} [1 - N(d_1)]$$

$$\sigma_S = \sigma_V \frac{V_0}{S_0} e^{(r_V - r_S)T} N(d_1)$$

153. The computer-readable medium of any one of claims 121 to 124, claims 132 to 136, or claims 143 to 151, wherein the computer-executable instructions use formula for calculating additional parameters, being discrete time volatility, correlation and covariance, for calibration with the model, said formula comprising:

$$\sigma_B = \sqrt{\ln\left(\frac{V_T^2 [1 - N(d_3)] e^{\sigma_V^2 T} + X^2 N(d_2)}{B_T^2}\right) \Big/ T}$$